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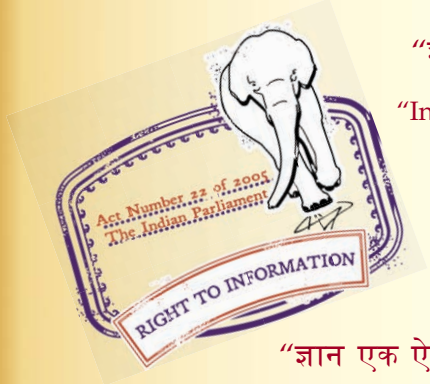
IS 8883-2-1 (1978): Methods of sampling chemicals and chemical products, Part 2: Sampling equipment, Section 1: For solids [CHD 1: Inorganic Chemicals]



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"Knowledge is such a treasure which cannot be stolen"

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IS : 8883 (Part II/Sec 1) - 1978
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Indian Standard

METHODS OF SAMPLING CHEMICALS AND CHEMICAL PRODUCTS

PART II SAMPLING EQUIPMENT

Section 1 For Solids

(First Reprint MARCH 1997)

UDC 543.053 : 661–405

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 7 *February* 1979

AMENDMENT NO. 1 MAY 1990
TO
IS : 8883 (Part 2/Sec 1) - 1978 METHODS OF SAMPLING CHEMICALS AND CHEMICAL PRODUCTS
PART 2 SAMPLING EQUIPMENT
Section 1 For Solids

(*Page* 5, *clause* **3.1.1**) — Insert the following after **3.1.1:**

'3.1.1.1 If required, the following four types of equipments may be used for crushing or grinding the samples to achieve the required particle size:

a) Lump crushers, such as claw-crushers for breaking lumpy products.

b) Coarse crushers, such as jaw crushers, impact breakers for primary grinding of coarse products to give 300-100 mm particle size.

c) Granulating and grinding mills to reduce particle size in the range of 25 mm to less than 1 mm.

d) Laboratory mills for dealing with relatively small samples and achieving finer grinding, such as jaw crushers (25-2 mm), hammer mills (20 mm - 300 μm), roll crushers (2 mm - 200 μm), ball/ disc mills (2 mm - 75 μm). Manual grinding may also be re-sorted to suitably, such as with a pestle and mortar.'

(CHD 1)

Printed at Simco Printing Press, Delhi, India

Indian Standard

METHODS OF SAMPLING CHEMICALS AND CHEMICAL PRODUCTS

PART II SAMPLING EQUIPMENT

Section 1 For Solids

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Indian Standard

METHODS OF SAMPLING CHEMICALS AND CHEMICAL PRODUCTS

PART II SAMPLING EQUIPMENT

Section 1 For Solids

0. FOREWORD

0.1 This Indian Standard (Part II/Section 1) was adopted by the Indian Standards Institution on 5 May 1978, after the draft finalized by the Chemical Standards Sectional Committee had been approved by the Chemical Division Council.

0.2 It may be emphasized that the most careful work in the laboratory or quantitative results may be rendered useless if care is not taken when drawing the sample. The sample has to be truly representative of the lot, should not include material other than that to be sampled and should not change in composition before testing.

0.3 Equipments commonly used for sampling of chemicals and chemical products in the form of solids are covered in this section. This standard does not cover statistical aspects of sampling like scale of sampling, number of tests, criteria for conformity or preparation of test samples. The general requirements and precautions in sampling of chemicals and chemical products have been covered in Part I of this standard.

0.4 In the preparation of this draft standard assistance has been derived from BS 5309 : Part 4 : 1976 Methods of sampling chemical products : Part 4 Sampling of solids, issued by the British Standards Institution.

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1. SCOPE

1.1 This standard (Part II/Section 1) deals with common equipment used in sampling of chemicals and chemical products in solid form. It also describes the procedures to be followed in using those equipment.

2. GENERAL PRECAUTIONS AND REQUIREMENTS

2.1 It is not possible to give general directions regarding sampling equipment which are sufficiently explicit to cover all cases. The guidelines

given in this standard should be supplemented by judgement, skill and sampling experience. It should be ensured that the samples drawn should represent the general character and average condition of the material.

2.2 The type of sampling equipment should be chosen depending upon :

a) type of sample (solid);
b) size and type of container (drum, tank, pipeline, etc);
c) amount of sample required for tests;
d) whether sample is in homogeneous or heterogeneous form;
e) reactivity of sample with material of construction of sampling equipment;
f) whether a spot or continuous or intermittent sample (from a pipeline) is required;
g) whether surface or middle or bottom sample is required; and
h) whether sampling is to be done hot, cold or at room temperature.

2.3 The whole sampling apparatus, including equipment, cords, connecting tubing and sample containers, should be free from any contaminating substance. The sample container should dc tightly closed immediately after sampling.

2.4 The operator engaged in sampling should have clean hands. Wear clean gloves. In certain cases it may be essential for the operator to wear gloves to safeguard against health or other hazards. In special cases the operator may also use goggles or gas mask.

2.5 To avoid mixing up of samples collected at one time, the sample containers should be labelled and clearly marked before transferring the sample. It is preferable to use separate sampling apparatus for separate samples. In marking the container, name of sample, number, date of sampling, supplier's name, batch number and other relevant details should be mentioned.

2.6 All metal components of sampling equipment used in a flammable atmosphere should be constructed of non-ferrous metal (to avoid sparks).

2.7 No sample container should be completely filled and space of 5 to 10 percent should be left.

2.8 Sampling equipment, connecting tubing and sample container should be constructed of a material unreactivc to the material to be sampled. Various materials used for construction of sampling equipment are as follows:

a) Glass (heat resistant borosilicate);

b) Stainless steel (04Cr17Ni12Mo2), alloy steels, mild steel, cast iron or wrought iron;

c) Non-ferrous metals (brass, copper, lead, aluminium);

d) Plastics (nylon, polyvinyl chloride, polyethylene);

e) Rubbers (acrylonitril butadine, styrenc, neoprcne nitrile).

2.9 After closing the sample container with a tight ground-glass stopper or cork, the mouth of the container may be sealed with sealing wax.

2.10 The sizes, dimensions and materials of construction of sampling equipment can be modified judiciously, where normal equipment are nappropriate.

3. SAMPLING EQUIPMENT FOR SOLIDS

3.1 General — The main factors which determine the type of equipment to be used are:

a) the particle size,

b) the quantity of material involved, and

c) whether it is static or in motion.

3.1.1 Under the particle size, the following broad classifications may be made:

a) Powder, granules and small crystals, such as, material passing through 3 mm square holes;

b) Coarse lupms, such as, material having pieces effective diameter up to 100 mm; and

c) Massive particles.

3.1.2 Under the quantity of material involved, there may be two categories:

a) Small amount, that is, up to 100 kg material; and

b) Bulk amount, that is, material more than 100 kg.

3.1.3 As regards the material in motion, if possible, the best place to take a sample is where the material is falling freely in a stream.

3.2 Sampling Equipment For Small Particles Less than 3 mm in Small Packings (Up to 100 kg) — The material to be sampled may be in bag, sack, drum, wooden barrel, keg, tin, bottle, etc.

3.2.1 *Scoop*

3.2.1.1 *Design and construction* — General design of common scoops is shown in Fig. 1. These are normally made of mild steel, but in special

cases where the material reacts with steel, the scoops made of resistant steels (for example stainless steel) or plastics can be used.

3.2.1.2 *Procedure* — Dip a scoop of suitable size into the material horizontally or at an angle (but not vertical) at the required spot, withdraw and level off the material with a levelling rod so that the material is not above the sides of the scoop. Transfer the sample drawn into a sample container preferably a glass bottle provided with a stopper.

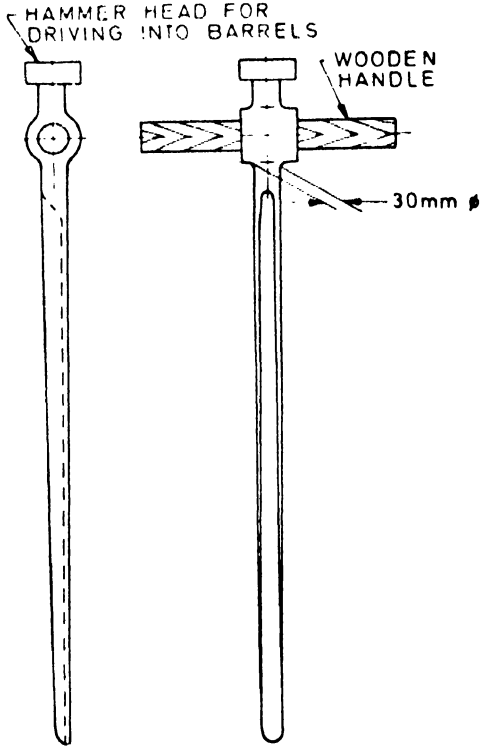


FIG. 1 SAMPLING SCOOP

3.2.2 *Sampling Tube* (*Also known as Spear or Thief*) — Various types of sampling tubes are in use. These can be classified as:

a) open-end sampling tube;

b) closed end sampling tube, undivided;

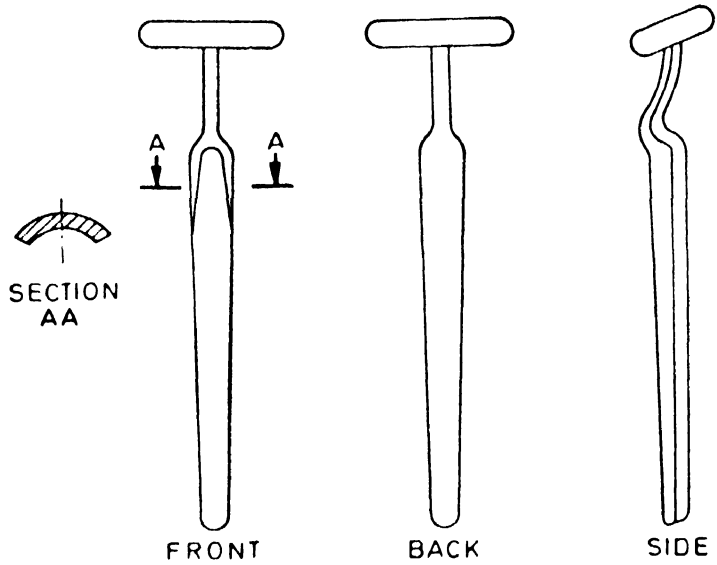
c) closed-end sampling tube, divided; and

d) grain sampling tube.

3.2.2.1 *Open-end sampling tube* (*spear*), *divided*

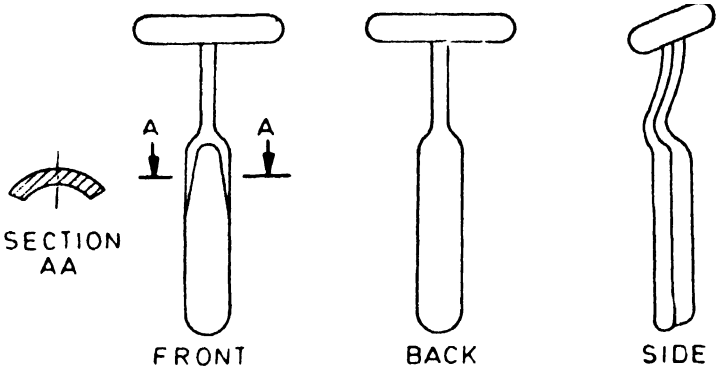
(a) *Design and construction* — Design of some common open-end sampling tubes is shown in Fig. 2. These are made of metal, steel, bronze, aluminium, alloy, etc, according to the purpose in view. The tube is fitted with *T* handle at one end. Cheese type (*see* Fig. 2A) and butter type (*see* Fig. 2B) tubes have the shape of a hollow tray at the other end, while cut-tube type tubes (*see* Fig. 2C) are sharpened to a blunt point at the other end. In cut-tube type sampling tubes the metal tube of a suitable bore and length is cut away to a depth of about half the diameter, for most or part of its length, leaving a U-shaped channel. The sampling tube should be of such a length so as to reach the bottom of the package of the sample. Typical dimensions of a sampling tube may be as shown in Fig. 2D.

(b) *Procedure* — Same as given under **3.2.1.2.**

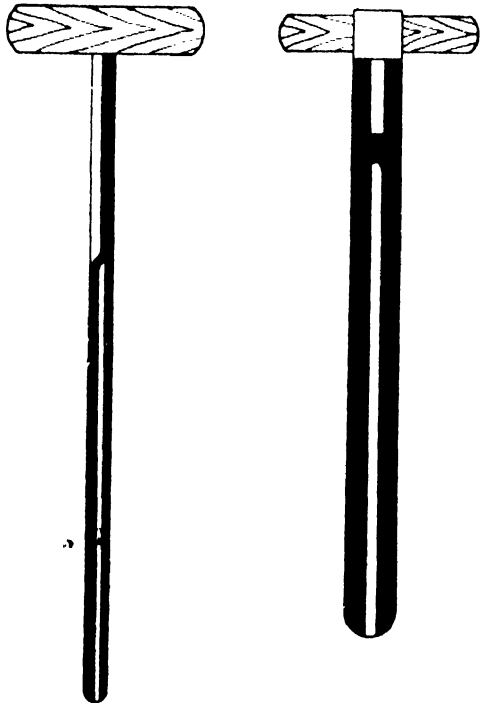


2A Cheese Type

FIG. 2 OPEN-END SAMPLING TUNE (SPEAR), DIVIDED — *Contd*

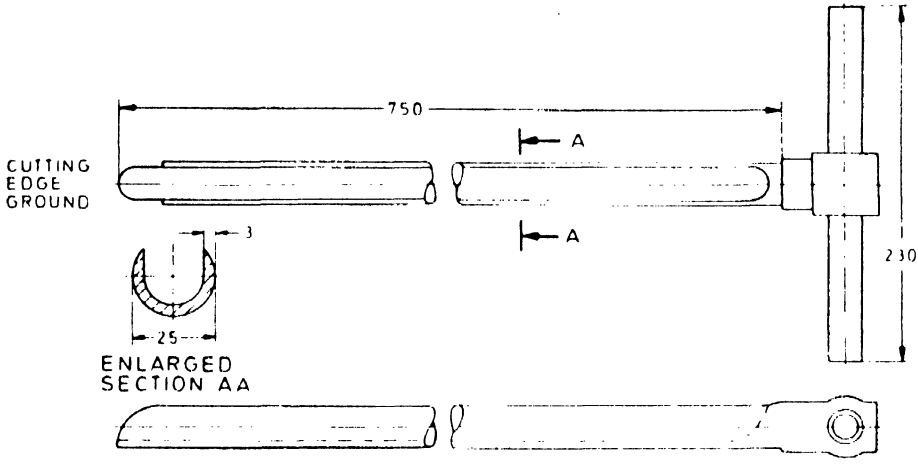


2B Butter Type



2C Cut-Tube Type

FIG. 2 OPEN-END SAMPLING TUBE (SPEAR), DIVIDED — *Contd*



All dimensions in millimetres.

2D Typical Dimensions

FIG. 2 OPEN-END SAMPLING TUBE (SPEAR), DIVIDED

3.2.2.2 *Closed-end sampling tube (spear) undivided*

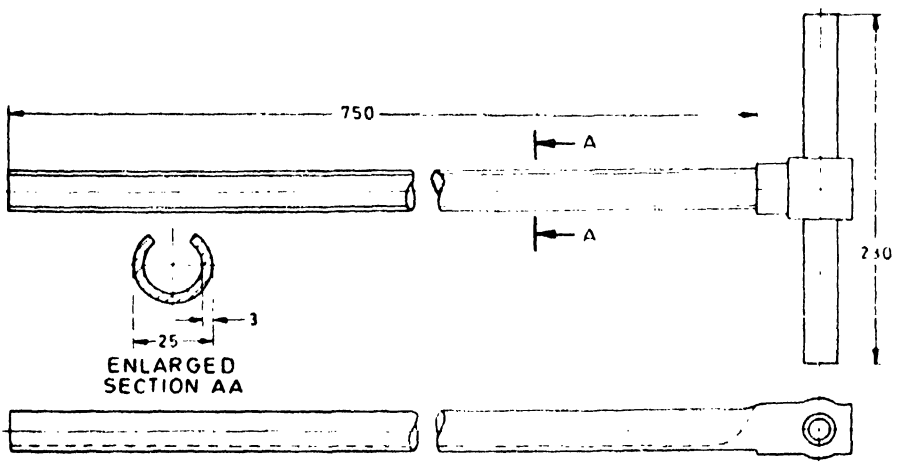
(a) *Design and construction* — Some of the undivided closed-end sampling tubes are shown in Fig. 3. Such a sampling tube consists of two concentric cylindrical tubes made of a mild steel, copper base alloys, aluminium, etc, and in special cases stainless steel, which is not affected by the material to be sampled. These tubes are closely fitting into each other throughout their entire length so that it is possible to rotate one tube within the other, a suitable handle being provided for this purpose. The tubes should be sufficiently thick to resist denting by accidental knocks. Dimensions of the sampling tube are chosen to suit the material being sampled. Longitudinal openings of about one-third of the circumference are cut in both tubes throughout the length either as one compartment (*see* Fig. 3A and 3C) or as multi-compartment (*see* Fig. 3B). In one position the two openings coincide and admit the material into the hollow inner tube.

By rotating the inner tube through 180°, the opening is tightly closed and a 'core' of material being enclosed therein, can be withdrawn. This type of sampling tube is usually provided with a locking arrangement so that the tubes are held together in any desired position. The outer tube

may be provided with a sharp conical end to facilitate penetration (*see* Fig. 3C) but the base of the cone is closed so that no material is entrapped in this portion. The height of the cone may be equal to its base diameter. The whole equipment is of sufficient length to penetrate an entire diagonal of the container being sampled. Diameter of the inner cylindrical space may be 20 to 40 mm depending upon the length of the tube. A length of 150 cm and a diameter of 30 mm can cater for most needs.

The two concentric tubes may be provided with V-shaped ports (*see* Fig. 3B) at their lower ends so placed that the material contained in the equipment can be drained through them, when the longitudinal openings are in line.

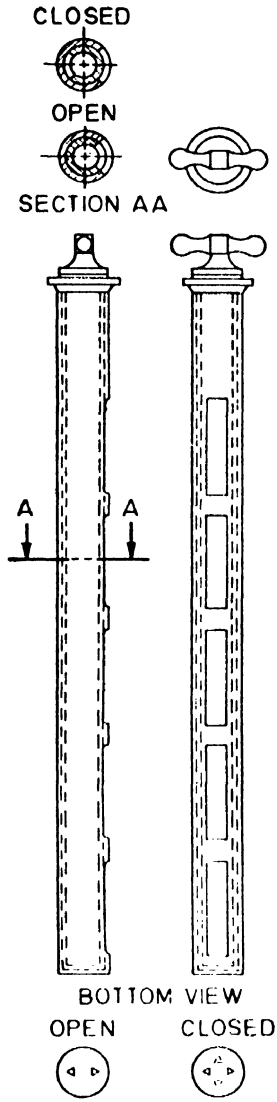
(b) *Procedure* — The equipment is inserted in closed position in an oblique direction till it touches the bottom. The material is admitted by rotating and opening the tubes and finally closing them (thus enclosing the sample inside the tube). Withdraw the sampling tube and transfer the sample collected into a suitable sample container. In case of sampling tube provided with V-shaped ports at the bottom (*see* Fig. 3B) the sample can be directly drained into the sample container, while in absence of bottom outlet, the sample tube containing the sample is opened by rotating the inner tube and the sample poured to a clean surface (white thick paper sheet or tray) and therefrom the sample is transferred to the sample container.



All dimensions in millimetres.

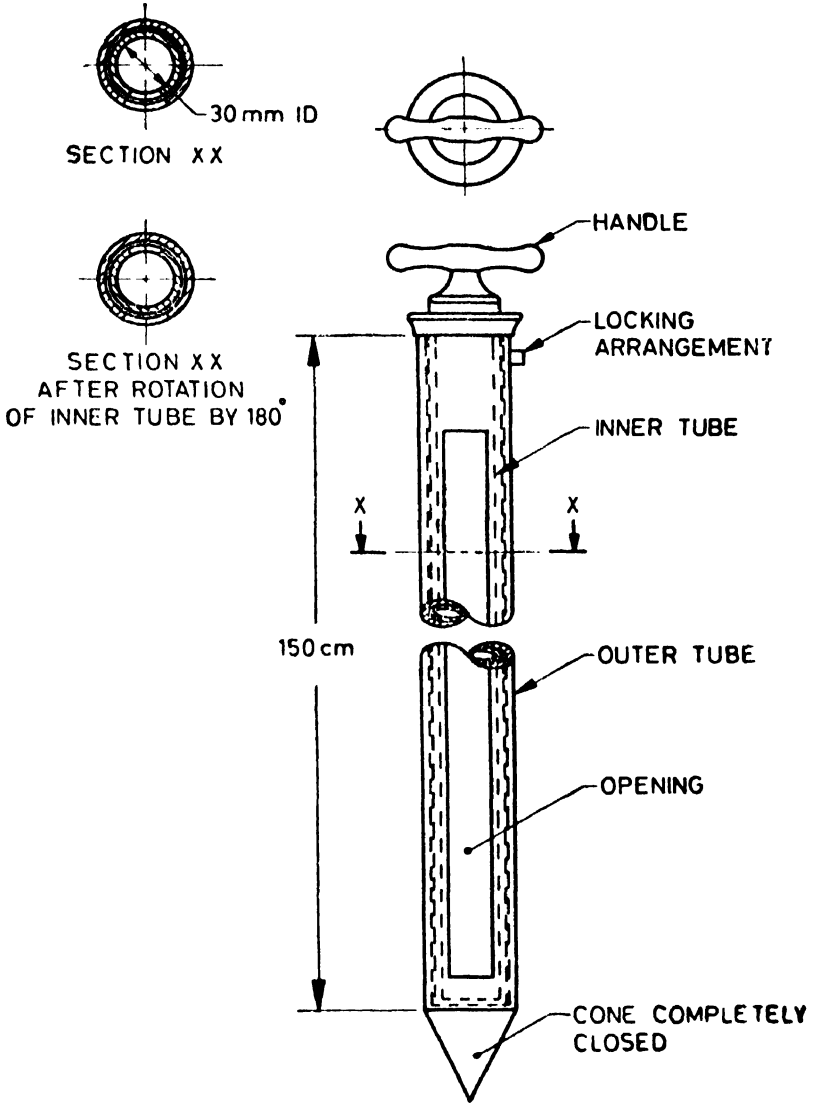
3A Single Compartment

FIG. 3 CLOSED-END SAMPLING TUBE (SPEAR), UNDIVIDED — *Contd*



3B Multi Compartment

FIG. 3 CLOSED-END SAMPLING TUBE (SPEAR), UNDIVIDED — *Contd*

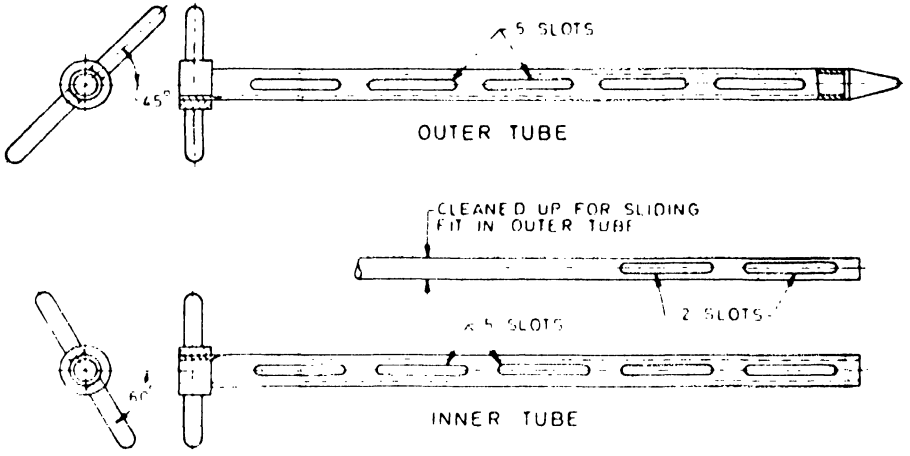


3C Single Compartment

FIG. 3 CLOSED-END SAMPLING TUBE (SPEAR), UNDIVIDED

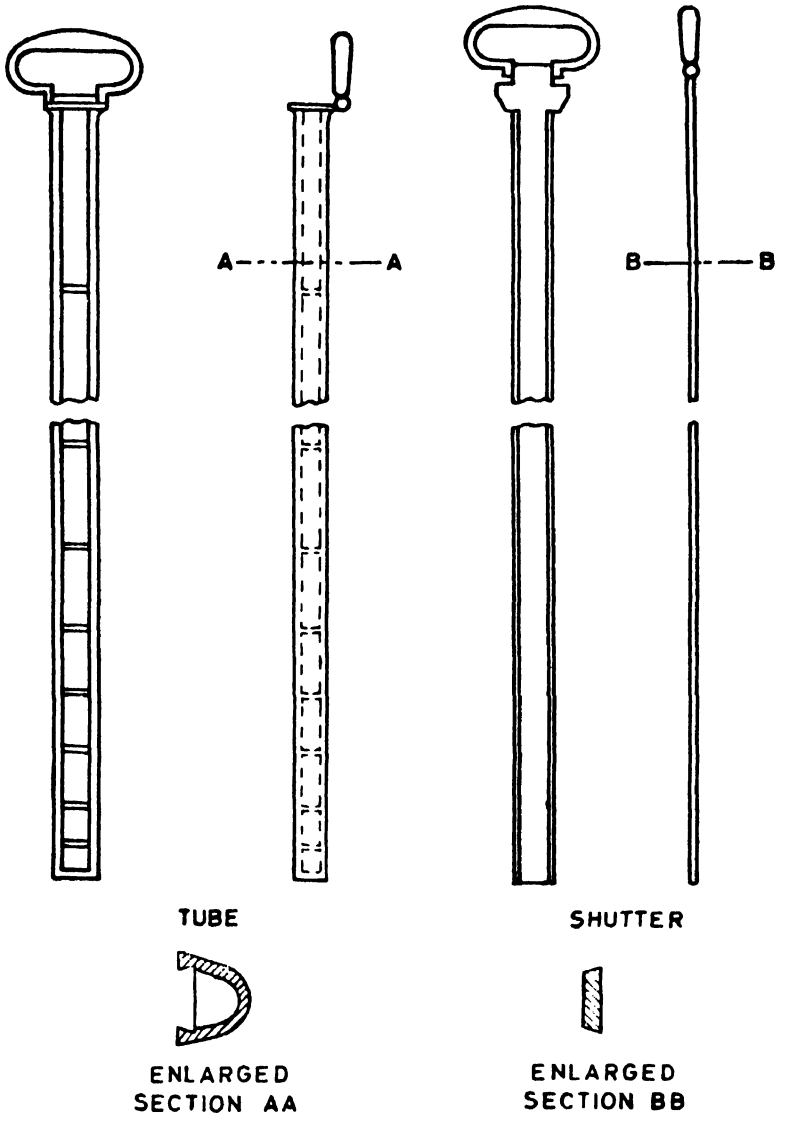
3.2.2.3 *Closed-end sampling tube, divided* (also known as Shuttered Sampling Tube)

(a) *Design and construction* — A few typical designs of divided closed-end sampling tube are shown in Fig. 4. Type 'A' (*see* Fig. 4A) consists of two sturdy metal tubes of mild steel, copper alloy, aluminium alloy and in special cases stainless steel, one of which is a close sliding fit inside the other. The metal used to make the tube should be inert to the material being sampled. The dimensions of the tube depend upon the type of container being sampled. The rods forming the handles are brazed or welded into the holes drilled in the collars round the ends of the tubes but shall not pass through the tubes. Down one side of the outer tube a series of slots is cut. A corresponding series of slots is cut on one side of the inner tube. The width of the slots should be at least three times greater than the size of the largest particle in the material being sampled. Marks are made on the collars holding the handles of both the tubes corresponding to the centre line of the slots, so that when a mark in the inner tube is lined up with the mark on the outer tube, the slots are open. Type 'B' tube (*see* Fig. 4B) is also of metal and has D-shaped cross section 25 to 50 mm wide and is closed by means of a closely fitting shutter.



4A Type A

FIG. 4 CLOSED-END SAMPLING TUBE, DIVIDED (SHUTTERED SAMPLING TUBE) — *Contd*



4B Type B

FIG. 4 CLOSED-END SAMPLING TUBE, DIVIDED (SHUTTERED SAMPLING TUBE)

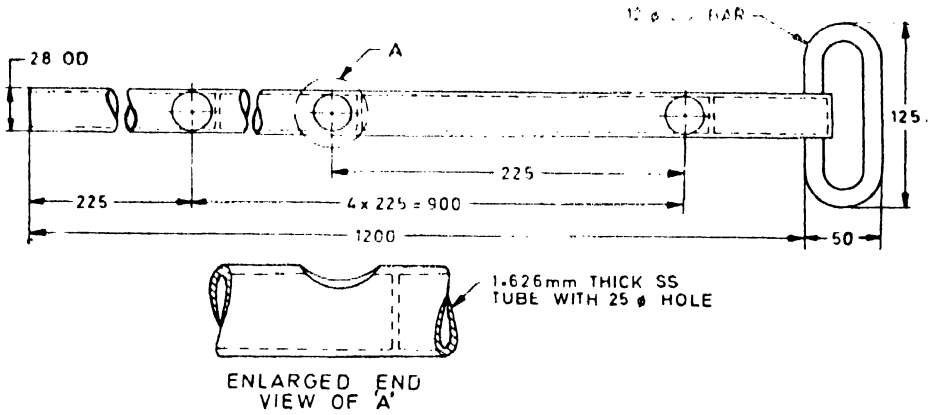
(b) *Procedure* — Check that the sampling tube is clean, use a pull through if necessary and see that the tubes can be rotated with respect to each other. In case of type 'A' (*see* Fig. 4A) rotate the inner tube until all the slots match up. Check that the centre marks on the collars correspond. Then rotate the inner tube until the handles arc at right angle to one another; in this position the slots should be closed. Insert the tube to required position in the material being sampled. It is preferable that the tube be inserted horizontally or at an inclination, with the slots positioned upside. Rotate the inner tube until the appropriate reference marks on the collars coincide, thereby opening the slots. Tap the upper end of the tube or work it to fill the material through the slots. Rotate the inner tube until the handles are again at right angles to close the slots and withdraw the sampling tube. Empty the tube by inverting it upside down and tipping out the sample from the open handle end of the tube and transferring it to sample container. Withdraw the inner tube from the outer tube and clean before next operation is started.

In case of type 'B' (*see* Fig. 4B), the equipment is inserted closed and the shutter is pulled out to admit the material. The tube is then closed by slowly pushing in the shutter to close the tube and then the tube containing the sample is withdrawn. The sample is transferred to a clean surface (thick paper, tray, etc) by pulling out the shutter tube and finally transferred to the sample container.

3.3 Sampling Equipment for Small Particles (Less than 3 mm) in Bulk Packing — The material to be sampled may be in tanks, car, wagon, hopper or heap. The sampling tubes described under **3.2.2.1** (Fig. 2), **3.2.2.2** (Fig. 3) and **3.2.2.3** (Fig. 4) can be used. The material of construction of the sampling tube should be such that it is inert towards the solid to be sampled. The length of the sampling equipment should be such that it can be penetrated diagonally up to the bottom of the container holding the sample. Besides the common sampling tubes, tubular sampling tube (*see* **3.3.1)** can be used. Shovels and sampling augers of appropriate dimensions may also be employed.

3.3.1 *Tubular Sampling Tube*

3.3.1.1 *Design and construction* — The design of a tubular sampling tube is shown in Fig. 5. The metal used for its construction is usually mild steel but in special cases stainless steel tube is required for sampling materials reacting with ordinary steels. The typical dimensions given in Fig. 5 are suitable for samples placed in drums of 200 to 250 litres capacity or other containers up to a height of 1.2 m. The tube can be longer for tanks, wagons, etc. As shown in the figure the tube has many inlets for the sample to fall inside the tube. A suitable handle is also provided.



All dimensions in millimetres.

FIG. 5 TUBULAR SAMPLING TUBE

3.3.1.2 *Procedure* — Push slowly the sampling tube from top of the container at an angle, the openings of the tube facing upside. Twist the tube slightly on either side in order to force the entry of the solid particles inside the tube. Withdraw the tube and transfer the sample on a clean surface (thick paper or tray). Finally, transfer the sample to the sample container.

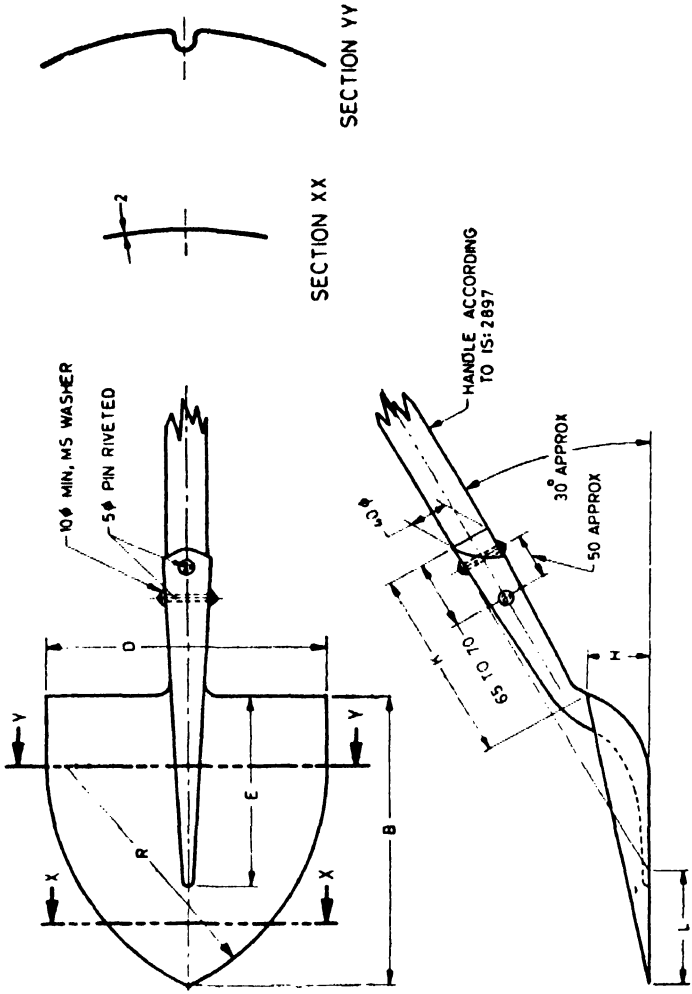
3.3.2 *Shovel*

3.3.2.1 *Design and construction* — Some common types of shovels are illustrated in Fig. 6. The design of handles is given separately in Fig. 7. The blades are made of steel while the handles can be manufactured from timber. The blades are hardened and tempered suitably to give hardness of 380 to 480 *HB*.

3.3.2.2 *Procedure* — If the material is lying in the open, the shovel can be used to collect sample at various points around the heap. When the sample is in the wagon or tank, there are some limitations and only surface samples can be collected. Insert the shovel at an angle (say 45°) into the solid sample, lift the shovel full of sample and transfer to the sample container marked for this purpose.

3.3.3 *Sampling Auger*

3.3.3.1 *Design and construction* — Various types of sampling augers such as simple auger, ship auger and shuttered auger are shown in Fig. 8. The auger is made of tempered steel or alloy steel (such as chromium steel).

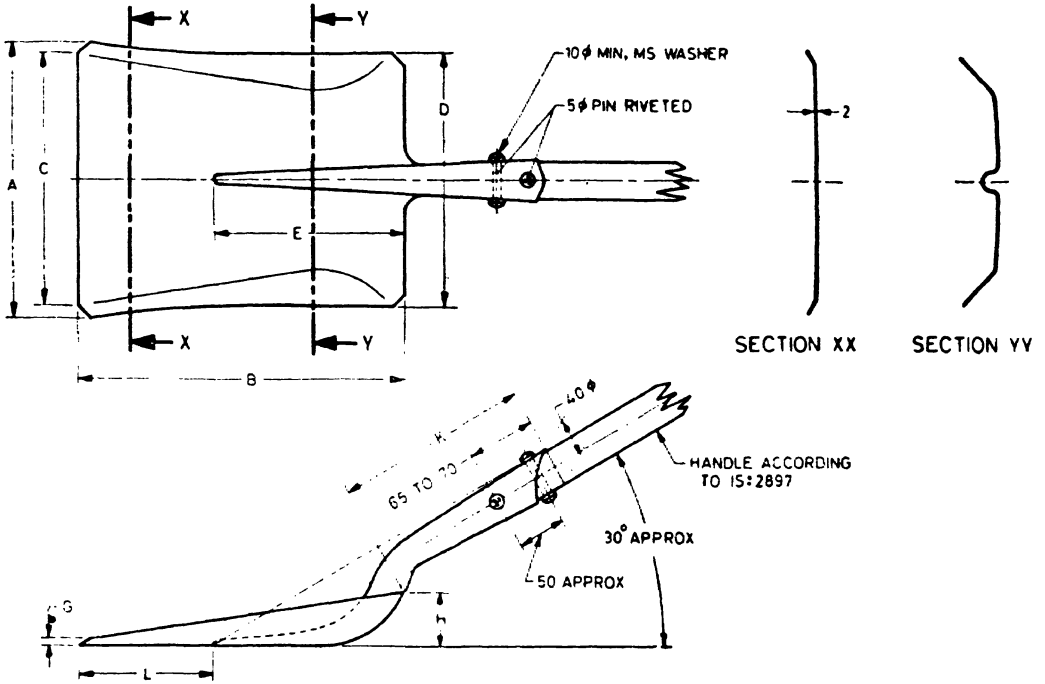


Nominal Weight of Blade kg	*B* ±6	*D* ±6	*R* (*Nom*)	*E* (*Nom*)	*H* (*Nom*)	*K* +6 −0	*L* (*Nom*)
1·6	330	275	255	200	60	200	115

All dimensions in millimetres.

6A Round Nose

FIG. 6 SHOVELS — *Contd*

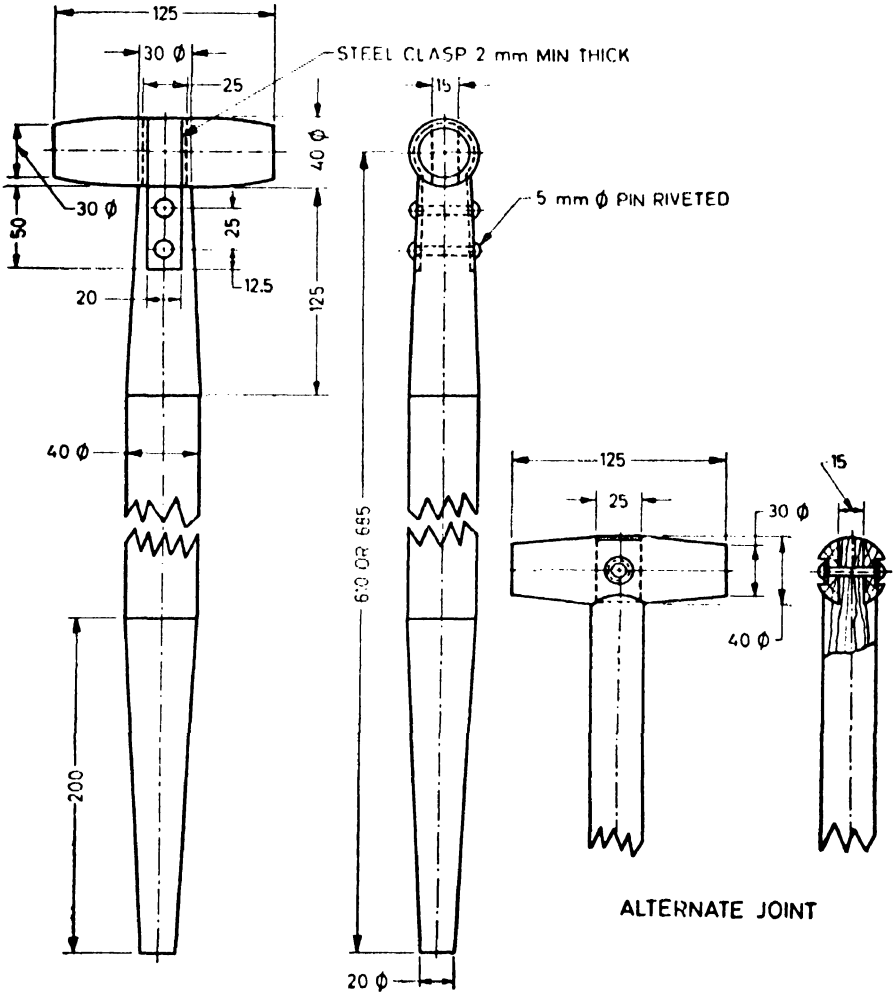


NOMINAL WEIGHT OF BLADE kg	*A* ±6	*B* ±6	*C* ±6	*D* ±6	*E* (*Nom*)	*G* (*Nom*)	*H* ±3	*K* ±6 −0	*L* (*Nom*)
1.8	280	340	255	255	200	6	55	200	140
2	305	370	280	280	200	6	60	200	170

All dimensions in millimetres.

6B Square Nose

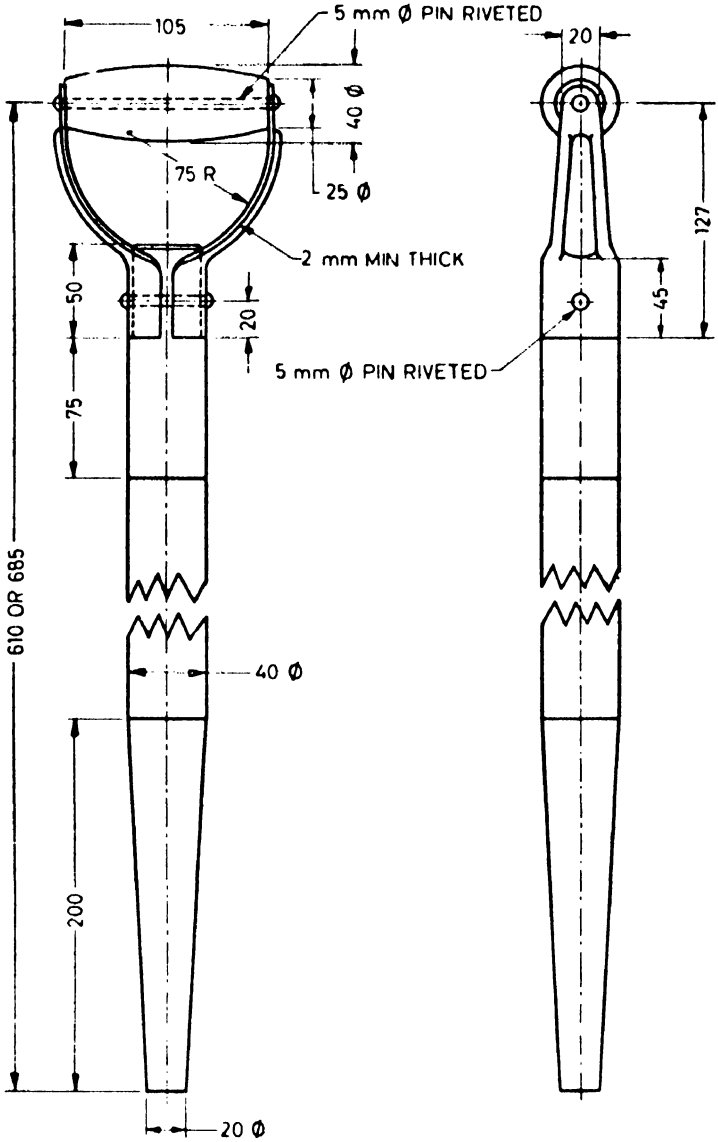
FIG. 6 SHOVELS



All dimensions in millimetres.

7A T-Type

FIG. 7 HANDLES FOR SHOVELS — *Contd*



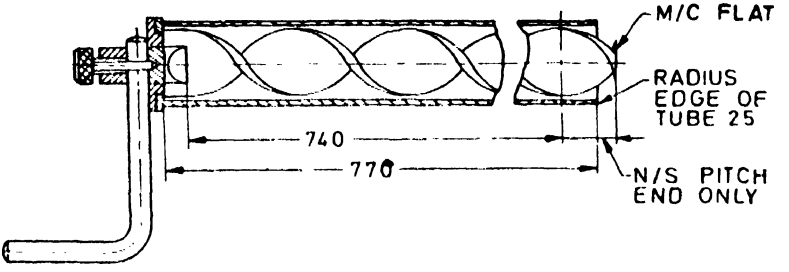
All dimensions in millimetres.

7B Crutch Type

FIG. 7 HANDLES FOR SHOVELS

8A Simple Auger

8B Ship Auger



All dimensions in millimetres.

8C Shuttered Auger

FIG 8 SAMPLING AUGER

3.3.3.2 *Procedure* — The auger is introduced into the material to be sampled, rotating the outer end. When the auger reaches the required depth pull out the equipment and transfer the solid particles on a clean surface (such as, paper or tray) by tapping the auger.

3.4 Sampling Equipments for Coarse or Lumpy Material (Up to 100 mm Effective Diameter)

3.4.1 *In Small Packings* (*Up to 100 kg*) – The scoop shown in Fig. 1 with or without modification can he used. Alternatively, a representative sample may be taken by emptying the material on a clean surface. Using a straightedge board or metal plate, make a cut into the material. Move the material on one side of the board away from the test of the material. Make another parallel cut into material that has not been moved. Move all the material between two cuts away from the bulk of material to form a

sample. Transfer the sample into a suitable sample container, usually a bag of high density polyethylene (HDPE) or an open mouth metal container.

3.4.2 *In Bulk Packing* — A suitable shovel (*see* Fig. 6) with or without modified dimensions can be used for sampling at the surface of the container. For obtaining the sample from the interior, a modified tubular sampling tube (*see* Fig. 5) can be employed.

3.5 Sampling Equipments for Massive Solid Pieces

3.5.1 *In Small Packing* (*Up to 100 kg*) — Select a few pieces at random. Break the lumps with chisel and hammer into smaller pieces. Where the material does not break, use saw for cutting bigger pieces into tiny pieces. From these broken pieces, take a proportionate number to form the sample. Alternatively the lumps can be placed on a clean surface and chipped off from all sides to about 10 mm depth, using a chisel and hammer or drill. The chippings or drilling can be collected from the surface underneath the sample pieces and transferred to the sample container. For certain physical tests for example compressive strength of cubes (of building material) perfect geometric samples (for example 50 mm cubes) can be made out of lumps of material using a fine chisel and hammer.

3.5.2 *In Bulk Packing* — This may consist of a larger number of massive particles. Only the pieces near the surface are accessible. However, the pieces packed deep into the container can be obtained. 'Having selected the pieces, the same methods of sub-sampling as indicated under **3.5.1** may be adopted.

3.6 Sampling Equipments for Material in Motion — The sampling equipment used for material in the form of falling stream only, are described here. The equipment used for sampling the material from moving conveyors are not discussed, because the design and dimensions of such equipments cannot be precisely specified.

3.6.1 *Sampling Equipments for Material in Falling Stream* — A scoop (*see* Fig. 1) of inert material of construction and required capacity can be used. Alternatively, suitable open-end sampling tubes (*see* Fig. 2) can also be employed. A shuttered closed end sampling tube (*see* Fig. 4) is quite useful.

3.6.1.1 *Procedure for sampling material in falling stream* — Introduce the scoop or the open-end sampling tube horizontally upside down, in the desired part of the falling stream. Turn the equipment right side up and collect spot sample. Quickly remove the equipment out of the stream. In case of shuttered closed end sampling tube, introduce the equipment with

shutter pulled down in the falling stream. Pull out the shutter and collect the sample. Again cover the inner tube with the shutter and draw the sampling tube out of the falling stream. The intermittent sample at different intervals can be drawn using a multi-compartment sampling tube (*see* Fig. 4A). The shutter can be opened slowly so that one compartment is filled at a time. The filled compartment may be moved out of the stream. The material so sampled should be collected on a clean surface (thick paper or tray made of metal or plastic) and subsequently transferred to a sample container.

3.7 Sampling Equipment for Solids Requiring Special Handling — Solids which need special handling belong to the following types. They may react with the constituents of normal atmosphere such as oxygen, carbon dioxide, moisture, and dust particles. Near industrial plants atmospheric polutants may also be present. Examples of such solids are barium hydroxide, calcium hydroxide and sodium metal. They may be pungent or foul smelling for example sodium sulphide and iodine or may be deliquescent for example caustic soda and calcium chloride.

By taking precautions and preventive steps suitable conditions of sampling can be created and common sampling equipments can be used. Dust and gaseous pollutants can be avoided by supplying clean air at the sampling point and possibly a small enclosure for the sampling area. Samples reactive at 35-40° should be cooled to 10-15°C before sampling and the sample container stored at 10-15°C.

3.7.1 *Sampling Equipments for Deliquescent Materials and Foul Smelling Solids* — Deliquescent materials are normally packed into air tight metal, wood or glass containers. The sampling probe (say closed-end sampling tube shown in Fig. 3B) may be inserted via the normal opening of the package or in case of wooden barrels, a hole may be drilled in the lid or the side using a brace of centre-bit. The sampling tube is introduced immediately and the sample drawn as mentioned under **3.2.2.2** (b). It is then transferred to a moisture-free (clean and dry) sample container provided with an air tight stopper. After sampling the hole in the sample packing is closed with a cork or wooden plug and sealed.

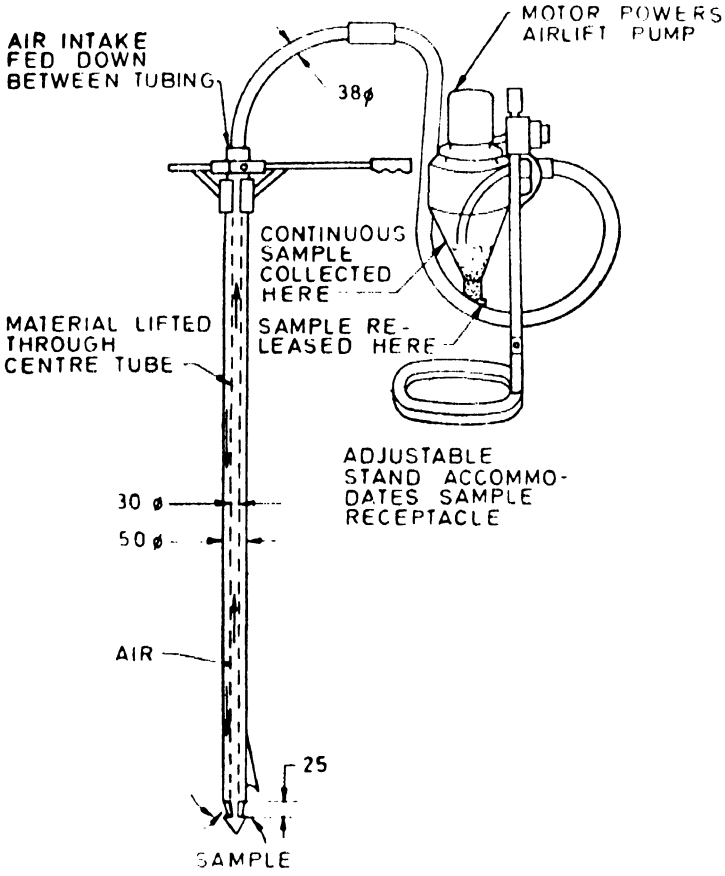
3.7.2 *Sampling Equipments for Materials Reactive Towards Oxygen and Carbon Dioxide* — In such cases a closed end sampling tube may be used (*see* Fig. 3B) but prior to its introduction into the sample the equipment is purged with an inert gas like nitrogen. For details of procedure refer to **3.7.1** and **3.2.2.2** (b). Even the sample container should be purged with the inert gas before transferring the sample collected.

3.7.3 *Sampling Equipment for Flammable Solids* — Such materials which are flammable when they come into contact with air or moisture, are

normally stored beneath a suitable organic liquid for example sodium under kerosene oil. The closed-end sampling tube (*see* Fig. 3B) is dipped in the liquid and sampling done beneath the surface oi the covering liquid. The sampling tube draws out the sample as well as some covering liquid. Directly transfer the sample from the sampling tube into the sample container which should contain two-thirds of its volume by the covering liquid. For other details of procedure refer to **3.7.1** and **3.2.2.2** (b).

3.7.4 *Sampling Equipment for Light-Sensitive Solids* — Light-sensitive materials like silver nitrate are sampled in conditions of diffused light allowing minimum exposure of the sample during sampling. The closed-end sampling tube as shown in Fig. 3B can be used because it facilitates direct transfer of the sample to the sample container. Procedure is the same as discussed under **3.7.1** and **3.2.2.2** (b). An important precaution taken in this case is that the sample container should be either amber-coloured glass bottle or otherwise black paper should be pasted all-around the bottle.

3.8 Continuous Sampling Equipment for Solids — Figure 9 shows a continuous sampling equipment, a typical pneumatic probe sampler. The sample is fed continuously into the cyclone: collector through a flexible pneumatic hose attached to the probe. The probe itself has inner and outer tubes. The chamber formed between the two pipes allows outside air to pass downward to the probe point, where pneumatic action takes place. This downward flow of air combines with the upward suction (inside the inner tube), to lift the sample upwards. At the same time it allows the probe point to be lowered into the vacated area.



All dimensions in millimetres.

FIG. 9 TYPICAL PNEUMATIC PROBE SAMPLER FOR GRANULAR MATERIAL

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Printed at Simco Printing Press, Delhi India